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ABSTRACT

The document briefly presents career information in the field of aerospace industry. Employment exists in three areas: (1) professional and technical occupations in research and development (engineers, scientists, and technicians); (2) administrative, clerical, and related occupations (engineers, scientists, technicians, clerks, secretaries, stenographers, typists, tabulating machine and computer operators, and other office personnel); and (3) production occupations (sheet metal work, machining and tool fabrication, other metal-processing, assembly and installation, inspecting and testing, flight checkout, materials handling and maintenance, and custodial). Aerospace employment is expected to rise by the mid-1980's. Job opportunities are most favorable for highly-trained scientists, engineers, and technicians. Less skilled and unskilled workers are needed to fill entry level production positions. (Employment statistics for the industry up to December 1975 are provided.) (Author/EC)

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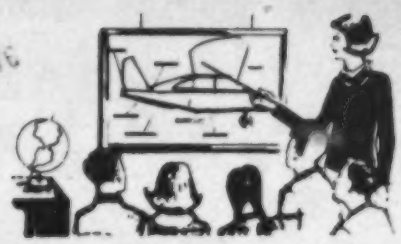

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CAREERS IN THE AEROSPACE INDUSTRY

June 1975

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Careers in the Aerospace Industry

Editor's Note: The following general introduction to the subject of careers in the aerospace industry stems from the many requests for career information received by the Association from students, teachers and others. In limited space, it is at best an overview and cannot therefore provide an insight into the hundreds of rewarding job categories which aerospace activity envelops.

Firms that engage in the research, development and production of aircraft, missiles, spacecraft and associated equipment make up what is known as the "aerospace industry." In 1974, almost one million people worked in the industry; the bulk of them in the manufacture and assembly of complete aircraft, aircraft engines, propellers, and auxiliary parts and equipment; the remainder in missiles and spacecraft and in companies that make electronic equipment and instruments for aircraft, missiles, and spacecraft. Thousands of workers in other industries produced parts, machinery, and equipment used in the manufacture of aerospace vehicles. Also, thousands of federal workers were engaged in aerospace related work, because the government is a major purchaser of the industry's products.

Nature of the Industry

Although there are many kinds of aircraft, missiles, and spacecraft, they all have the same basic components: a frame to hold and support the rest of the vehicle, an engine or engines to propel the vehicle, and a guidance and control system.

Types of aircraft vary from small personal or business planes that cost not much more than an automobile, to multi-million dollar jumbo transports and supersonic fighters.

Missiles are chiefly for military use. Some are capable of traveling only a few miles, others have intercontinental ranges of 7000 miles or more.

Most of the country's spacecraft are built for the National Aeronautics and Space Administration and the Department of Defense to explore outer space or to monitor conditions within the earth's atmosphere.

Major aircraft, missile and spacecraft firms contract with government or private business to produce an aerospace vehicle. As contractors, they are responsible for managing and coordinating the entire systems development. Scientists and engineers, usually in a laboratory environment, continuously work on expanding the technological base needed for new products. When sufficient technology is in hand the firm's engineering department commences with preliminary design and development testing. When the design has been proved, final design drawings and specifications for the product are prepared and go to the production department where planners work on the many details regarding machines, materials, and operations needed to manufacture the vehicle. Production includes designing and producing the tools and fixtures needed to produce thousands of parts and accessories that make up an aerospace vehicle. Parts and components are inspected and tested many times before being assembled, and completed systems are examined for conformance to specifications. Before a finished vehicle is delivered, it is checked out by a team of inspectors and flight-tested.

Aircraft, missiles, and spacecraft manufacturers generally make many components of a craft and do final

assembly work. However, because there are so many specialized components that make up the complete systems, much of the work is subcontracted to other firms. There are thousands of subcontractors involved in the production of parts that go into aerospace vehicles. Some subcontractors make parts or supplies such as bearings, rocket fuels, or special lubricants. Others produce subassemblies such as communication or guidance equipment, or major components such as jet engines.

Because of the complex and changing nature of aerospace technology, firms need workers with many different job skills that vary according to their fields of interest.

Occupations in the Industry

Professional and Technical Occupations. Research and development (R&D) are vital to the aerospace industry. Efforts are being made to develop vehicles with greater speeds, ranges, and reliability. Engines with more power and new sources of rocket propulsion such as nuclear and electric energy are being investigated and may be available in the future. Metals and plastics are continually being explored for wider capabilities, as are electronic guidance and communication systems. The pace of discovery in aerospace techonolgy is so rapid that some equipment becomes obsolete while still in an experimental stage or soon after being put into production.

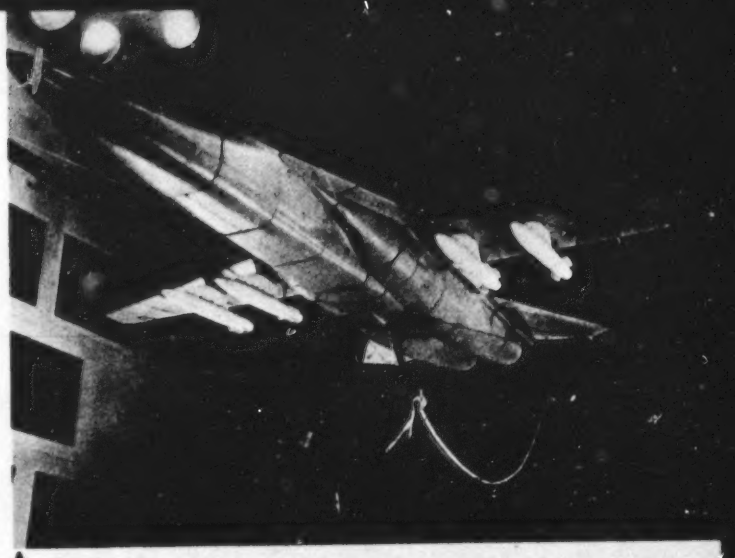
Emphasis on R&D makes the aerospace industry an important source of jobs for technical personnel. Almost one-fourth of all employees are engineers, scientists, and technicians, a considerably higher proportion than in most other manufacturing industries.

Many kinds of engineers and scientists work in the aerospace industry. Electronic, electrical, aerospace, chemical, nuclear, mechanical, and industrial engineers are among the larger engineering classifications. Scientists in the industry include physicists, mathematicians, chemists, metallurgists, and astronomers. Aerospace engineers and scientists work in a wide and varied range of applied fields such as materials and structures, energy and power systems, and space sciences.

Among the many types of workers assisting scientists and engineers are technicians such as draftsmen, mathematics aides, and engineering and science technicians. Engineers and scientists also work with other technical personnel such as production planners, who plan the layout of machinery, movement of materials, and sequence of operations for efficient manufacturing processes, and technical illustrators who help prepare manuals and other technical literature describing the operation and maintenance of aerospace products.

Administrative, Clerical, and Related Occupations. Managerial and administrative jobs generally are comparable to similar jobs in other industries, except that they are often filled by engineers, scientists, and other technical personnel. People in these jobs include executives responsible for the direction and supervision of research and production and officials in departments such as sales, purchasing, accounting, and industrial relations. The industry also employs many thousands of clerks, secretaries, stenographers, typists, tabulating machine and computer operators, and other office personnel.

Production Occupations. About one-half of all workers in the aerospace industry have plant or production-related jobs. Production workers can be classified in the following groups: Sheet metal work; machining and tool fabrication; other metal-processing; assembly and installation; inspecting and testing; flight checkout; and materials handling, maintenance, and custodial.



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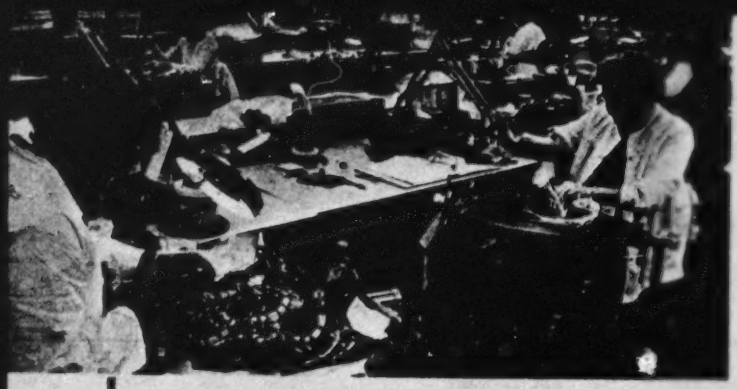
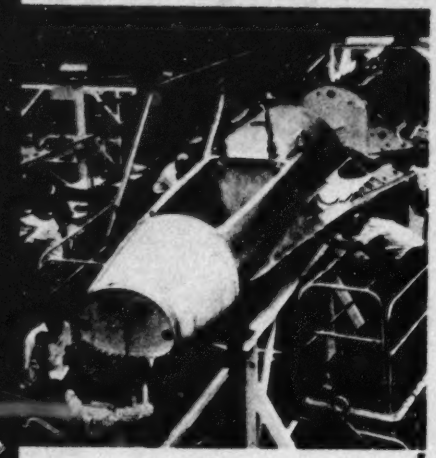
Aerospace *engineers* (A&B) play a vital role in America's aerospace activities. Engineers working in the aircraft field are usually called aeronautical engineers. Those in the field of missiles, rockets, and spacecraft often are referred to as astronautical engineers. Aerospace engineers usually have degrees in both fields.

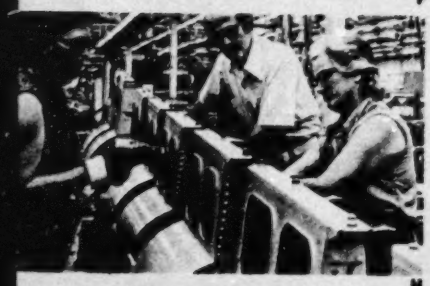
In aerospace the *scientist* (C) is a key man in Research and Development (R&D). He directs himself to the discovery of new products and processes. While the engineer applies his skill to solving specific problems with known facts, the scientist probes the unknown. He seeks to know "why?" rather than "how?"; and he attempts to present the rules upon which the engineer may build.

Managerial positions (D) in aerospace are often filled by engineers, scientists, and other technical personnel who are responsible for the direction and supervision of research, development and production.

D







Production Workers

Assembly and installation workers (E&F) include final assemblers of complete aircraft, missile or rocket assembly mechanics, and assemblers specializing in other systems such as power plants, electrical wiring, heating, ventilation and plumbing.

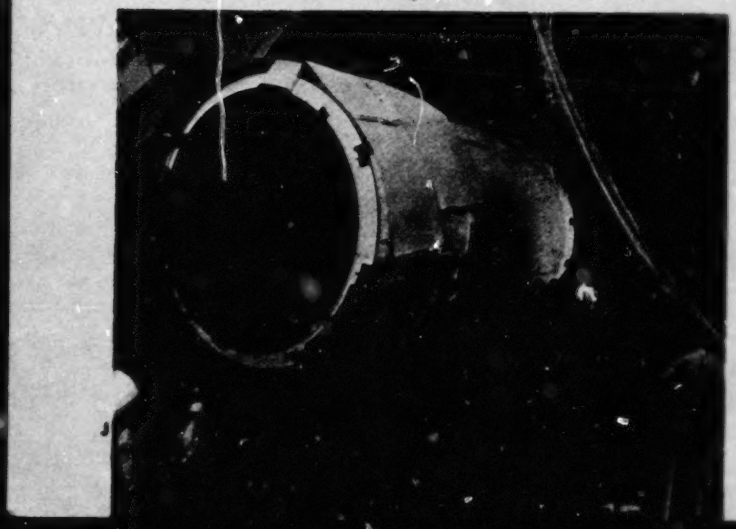
Sheet-metal workers follow blueprints and other engineering information to shape complete parts from sheets of metal by hand or machine methods.

Machinery and tool fabrication workers shape and finish metal parts with machine tools, as well as producing jigs, fixtures, tools, and dies required for the production and assembly of parts for aerospace vehicles.

Other metal-processing workers (G&H) use mechanical and electrical devices to form and join fabricated parts and chemically and heat-treat parts to clean, change or protect their surfaces or structural conditions.

Inspecting and testing workers include inspectors who examine components ordered from other firms, machine parts inspectors and fabrication and assembly inspectors.

Flight checkout workers (I&J) check out every part of an aircraft or spacecraft before its first flight.



Employment in the Industry

From December 1968 to December 1971, aerospace employment dropped from 1,403,000 to 924,000. It then proceeded to climb to 973,000 by December 1974. Current estimates indicate that during 1975, aerospace employment will decrease by 2.8 percent — to 946,000 at year end.

Production worker employment is expected to decrease from 483,000 in December 1974 to 463,000 by year end 1975 — a decrease of 4.2 percent, while scientists and engineers decrease from 166,000 to 163,000 or down 1.8 percent, and technicians remain steady at 67,000 during the same period of time. The employment of clerical, administrative and maintenance personnel is expected to decrease by 1.6 percent, from 257,000 to 253,000.

It is estimated that 55,400 people, including 6900 scientists and engineers, will be employed in the final assembly of transport aircraft at the end of 1975. This estimate compares with 63,600 workers at the end of 1974, and a high in recent years of 126,200 reached at the end of 1968. These figures do not include transport-related employment of subcontractors and engine manufacturers.

Employment in missiles, space vehicles and parts is predicted to remain at 209,000 at the end of 1975, the same as 1974. The area of "other related products," which includes other aerospace and non-aerospace products manufactured in plants primarily devoted to aerospace, will remain steady at about 210,000 employees.

Aerospace jobs exist in almost every state. The largest concentration is in California. Other states with large numbers of aerospace jobs include New York, Washington, Connecticut, Texas, Florida, Ohio, Missouri, Pennsylvania, Massachusetts, Kansas, Alabama, Maryland, New Jersey, and Georgia.

By geographic regions, total aerospace employment is expected to show an increase of 8.7 percent in the South Atlantic area; however, this gain is offset by the declines in other regions. The largest decline — 6.5 percent — is predicted for the Pacific area.

AEROSPACE INDUSTRY EMPLOYMENT
by Occupational Classification
December 1968 to December 1975
(Employment in Thousands)

Month and Year	AEROSPACE EMPLOYMENT				
	TOTAL	Production Workers	Scientists & Engineers	Technicians	All Others
Dec. 1968	1,403	738	321	81	363
Dec. 1969	1,295	658	203	72	362
Dec. 1970	1,069	528	187	67	307
Dec. 1971	924	448	139	60	257
Dec. 1972	944	473	168	65	238
Dec. 1973	982	484	164	66	248
Mar. 1974	990	474	163	66	287
June 1974	962	461	165	67	249
Sep. 1974	976	482	168	67	259
Dec. 1974	973	483	166	67	257
June 1975*	951	464	165	67	255
Dec. 1975*	946	463	163	67	253

* Forecast

The aerospace industry continued to be one of the nation's primary employers of scientists and engineers for R&D. In 1974, the nation employed 360,000 scientists and engineers for R&D; aerospace accounted for nearly 20 percent of the total with 70,300 workers in this category.

Production workers' earnings in the aerospace industry are higher than those in most other manufacturing industries. In 1974, for example, production workers in plants making aircraft and parts averaged $5.40 an hour; production workers in all manufacturing industries as a whole averaged about $4.40 an hour.

Training

A college degree in engineering or in one of the sciences usually is the minimum requirement for working as an engineer or scientist in the aerospace industry. A few workers obtain these jobs without a college degree, but only after years of work experience and some college-level training. An undergraduate preparing for a career as an aerospace engineer or scientist should get as solid a background as possible in mathematics and physics. More specialized fields of the industry require graduate school education or on-the-job training.

An increasing number of technical occupations such as draftsmen and electronics technicians require two years of formal education in a technical institute or community college. Others may qualify through several years of diversified work experience.

Production jobs require many skill levels. Some less skilled jobs that require repetitive work can be filled by workers with little or no training and can be learned quickly on the job. More skilled jobs require some combination of job related experience, high school or vocational education, and on-the-job training. Many workers often start at trainee level positions and work their way up to the more skilled occupations.

Apprenticeship programs are sometimes available for craftsmen such as machinists, tool and die makers, sheet-metal workers, aircraft mechanics, or electricians. The programs vary in length from three to five years depending on the trade and during this time the apprentice handles work of progressively increasing difficulty. Besides on-the-job training, the apprentice receives classroom instruction in subjects related to the craft.

Because complex and rapidly-changing products require highly trained workers, aerospace plants sometimes support formal training to supplement day-to-day experience and help workers advance more rapidly.

Outlook

Employment in the aerospace industry is expected to rise above recent levels by the mid-1980's. Thousands of jobs will open each year because of the growth expected in the industry, and to replace workers who retire, die, or transfer to jobs in other industries. Job opportunities should be most favorable for highly-trained workers such as scientists, engineers, and technicians. Less skilled and unskilled workers will also be needed to fill entry level production positions.

Growing demand for civilian aircraft products is an important element underlying the expected increase in aerospace employment. The increasing mobility of the population should encourage expanded use of large wide-bodied commercial aircraft and development of rapid air-taxi operations between major urban centers. Increased business flying, expanded use of helicopters for such tasks as medical evacuation and traffic reporting, and exports of aircraft to foreign nations are some of the other major factors influencing the growth of civilian aircraft manufacturing.

A large proportion of aerospace products are primarily for national defense and to advance the nation's goals in space. Therefore, the industry's future depends largely on the level of federal expenditures. Changes in these expenditures usually have been accompanied by sharp fluctuations in aerospace employment.